Modelling Virtual Patients and Generating Feedback using Semantic Web Technologies

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Background and purpose

A variety of computer programs called virtual patients systems are available today. Virtual patients are designed to emulate realistic clinical cases on a computer, and help students to practice diagnosis and clinical reasoning. They are used as an integral part of the curriculum in many medical schools (1, 2).

However, the technologies currently used to build virtual patients present limitations. Feedback has to be edited manually by medical experts, and the feedback provided is often not adapted to each student's interactions with the virtual patient. This makes creating and editing a virtual patient time-consuming, and limits its pedagogical impact.

This presentation demonstrates research on automatic feedback generation for virtual patients, using a group of methods and technologies collectively known as the semantic web.
The semantic web is designed to formally represent information about digital documents and other resources (such as people and events) using RDF (Resources Description Framework) (3).
It is also possible to describe concepts, classify them and define their properties using OWL (Web Ontology Language) (4). These formal languages also allow re-use of data from external sources from the web.
To generate feedback, an adequate computer model has to be designed to represent virtual patients and students' interactions. The semantic web allows rich data modelling, and is therefore superior to traditional data technologies such as relational databases and XML for this purpose.

Methodology

A review of virtual patient commonly in use in medical education has been performed, using the literature and available demonstration version of virtual patient systems. From this review, the feedback limitation has been identified, and a proposed semantic model of virtual patients has been designed.

This model harnesses the strengths of the semantic web: formal description of resources, and formal ontology allowing querying and automated reasoning. The model also includes data extracted from existing sources on the web.

To test practical applications for this model, a comparison with the popular virtual patients model Medbiquitous (5) has been performed. Data from existing cases downloaded from the eVip project (6) was analysed and re-written using the proposed semantic model. Associated to this semantic

model, queries and logic rules were programmed, in order to access data from the model and provide feedback.

Future work

To assess the benefits of the proposed model, data will be gathered through guided interviews with small groups of medical students. Students will be asked to go through the eVip case in a guided interview, and their decisions will be recorded and formalised. Their decision paths will then be anonymously reviewed by experienced clinicians for corrections and feedback. The resulting feedback will be compared with the model's generated feedback, and the model will be improved using these results.

A larger study will then evaluate how the model performs with a user interface, on a larger sample of students.

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